14. (Once Amended) The apparatus as claimed in claim 1, wherein the emitter excitations include energies transported by carrier diffusion.

32. (Once Amended) The apparatus as claimed in claim 31, wherein a concentration of cadmium (Cd) is between 20% and 30%.

33. (Once Amended) The apparatus as claimed in claim 1, wherein a distance from a p-n junction in the p-n junction diode to the catalytic collector is less than three times a diffusion length of minority carriers [electrons] in the p-n junction diode.

34. (Once Amended) The apparatus as claimed in claim 1, wherein the catalytic collector further includes:

a catalyst,

wherein total path traveled by energetic carriers between a catalyst surface exposed to adsorbate reactants and a semiconductor of the excitation emitter is less than three times the total energy mean free path of the energetic carriers along the path.

A3

46. (Once Amended) The apparatus as claimed in claim 1, wherein the catalytic collector [has] includes a material having Debye temperature less than 500 degrees Kelvin.

A4

53. (Once Amended) The apparatus as claimed in claim 50, wherein the electrode underlayer metal has a thickness [such that total energy mean free path of energetic carriers in the electrode underlayer metal is] less than three times energy mean free path of the excitations going through it.

A5

66. (Once Amended) The method of claim 65, wherein the coupling includes forming a catalytic collector in the adsorbate-catalyst with one or more quantum confinement surface structures.

A6

68. (Once Amended) The method of claim 65, wherein the coupling includes forming a catalytic collector in the adsorbate-catalyst and the optimizing includes [forming] constraining the thickness of a region between a surface of the catalytic collector exposed to adsorbate reactants and the excitation emitter, the region having a thickness of less than three energy mean free paths of hot carriers exchanged between [electrons of] the catalytic collector and the excitation emitter.

69. (Once Amended) The method of claim 65, wherein the optimizing includes selecting a substrate with band gap energy less than or equal to a selected excitation in the adsorbate-catalyst [system].

A6

70. (Once Amended) The method of claim 65, wherein the optimizing includes adjusting a forward bias of the diode such that a [conduction] band of excitation energy in the excitation emitter matches [the diode is equal to a selected] a band of excitation energies in the adsorbate-catalyst [system].

A7

78. (Once Amended) The method of claim 72, wherein the method further includes:

modifying one or more electron density of states of a material in a catalytic collector to match a selected range of energy transitions of one or more excitation band structures of an adsorbate-catalyst system having the adsorbate reactants.

A8

102. (Once Amended) A method of stimulating reactions, comprising:

creating hot carriers in an excitation emitter, the excitation emitter in contact with a catalytic collector, by applying power to a diode in the excitation emitter;

transporting the hot carriers originating in the diode into the catalytic collector having catalyst material;

manipulating thickness properties of the catalyst material such that the hot carriers remain hot while they are transported to a surface of the catalytic collector, the surface being exposed to reactants.

14
~~110~~. (Once Amended) The method of claim 102, wherein the reactants have a partial pressure such that not more than one monolayer forms for each of the reactants on a surface of the catalyst material.

A9

142
~~151~~. (New) The apparatus as claimed in claim 1, wherein the emitter excitations include energies transported by resonant tunneling.

A10

143
~~152~~. (New) The apparatus as claimed in claim 1, wherein the catalytic collector further includes a catalyst, a material of the catalyst and an electrode of the p-n junction diode being one and the same.

153. (New) The method of claim 70, wherein a hot carrier is an electron and the excitation band of the emitter is its conduction band.

154. (New) The method of claim 70, wherein a hot carrier is a hole and the excitation band of the emitter is its valence band.

155. (New) The method of claim 72, wherein the method further includes:

A10 modifying one or more electron density of states of a material in a catalytic collector to match a selected excitation band structure of an adsorbate-catalyst system having the adsorbate reactants.

156. (New) The method of claim 78, wherein the modifying includes forming one or more electron interferometer structures to cause a plurality of hole reflections.

157. (New) A method of stimulating reactions, comprising:

applying power to a diode in an excitation emitter, the excitation emitter being in contact with a catalytic collector;

creating hot carriers in the excitation emitter;

coupling excitation energy of the hot carriers to an excitation band structure of the catalytic collector by using resonant tunneling;

constraining the thickness properties of a coupling material of the catalytic collector such that the resonant tunneling of the excitation energy experiences an energy transfer rate between excitation emitter and catalytic collector not less than 3% of the competing, energy loss rates.

158. (New) The method of claim 157, wherein the constraining the thickness properties includes constraining the thickness to less than 200 nanometre (nm) for a conducting coupling material of the catalytic collector.

159. (New) The method of claim 157, wherein the constraining the thickness properties includes constraining the thickness to less than 100,000 nanometre (nm) for a non-conducting coupling material of the catalytic collector.

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REMARKS

This is a preliminary amendment to U.S. Patent Application No. 09/631,463, filed August 3, 2000, which claims the benefit of U.S. Provisional Application No. 60/186,567, filed March 2, 2000.